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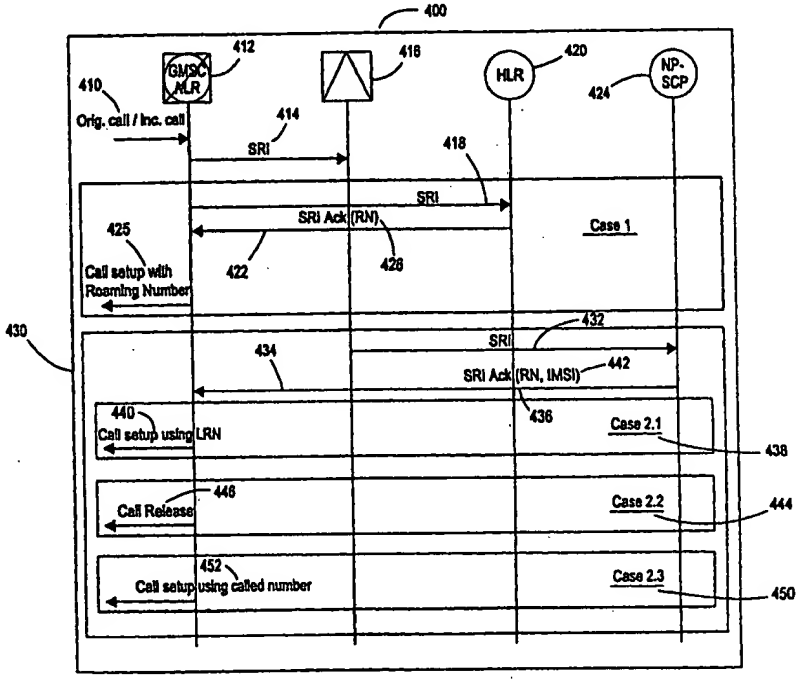
(54) Title: METHOD FOR PROVIDING NUMBER PORTABILITY IN A TELECOMMUNICATIONS NETWORK

(57) Abstract

A method for providing number portability in a telecommunications network is disclosed. The method provides number portability database queries that uses existing fields. The method includes receiving a call, determining how to route the call by looking at an identity information field and determining whether the call is ported or non–ported by analyzing the identity information field. The method further includes providing routing information associated with the call, the routing information including the identity information field, the identity information field further including a mobile station roaming number field and an international mobile subscriber identity field. The determining how to route the call further includes determining how to route the call by looking at a mobile station roaming number field in the information identity field. The determining whether the call is ported or non–ported further includes determining whether the call is ported or non–ported by analyzing an international mobile subscriber identity field in the information identity field.



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METHOD FOR PROVIDING NUMBER PORTABILITY IN A TELECOMMUNICATIONS NETWORK

BACKGROUND OF THE INVENTION

1. Field of the Invention.

This invention relates in general to telecommunication networks, and more particularly to a method for providing number portability in a telecommunications network.

2. Description of Related Art.

Local number portability (LNP) is a telecommunication service that offers to subscribers the benefits of service provider portability, location portability and service portability. Number portability (NP) allows subscribers to retain their directory number (DN) when the subscriber changes service providers.(service provider portability), location (location portability), or service (service portability).

Service provider portability is intended to give subscribers the ability to choose to obtain local telephone services from any service provider while retaining the same telephone number. Location portability permits subscribers to retain the same telephone number after moving to a new location, even if the new location is outside the servicing area of the current serving end office. Finally, service portability allows subscribers to obtain any type of telecommunications services while retaining the same telephone number, regardless of the capabilities of the current serving end office.

The global system for mobile communications (GSM) system, however, was designed to allow roaming. In GSM, subscribers can still be reached under their own subscriber number independently of their location. A subscriber identity module (SIM) provides mobile equipment with an identity and therefore identifies the subscriber to a network. A personal identification number (PIN) is stored on the SIM. In GSM, a gateway mobile services switching center (GMSC) is the interface of the cellular network to the public switched telephone network (PSTN). Additional mobile services switching centers (MSCs) may also be provide. Some or all of the additional MSCs may not have access to the fixed network. A base station subsystem (BSS) provides a base transceiver station (BTS) for communicating with mobile stations through the radio interface and a base station controller (BSC). A home location register (HLR) stores the identity and user data of all subscribers

belonging to the area of the related GMSC. These are permanent data such as the international mobile subscriber identity (IMSI) of an individual user, the user's phone number from the public network, which is not the same as the IMSI, the authentication key, the subscriber's permitted supplementary services and some temporary data. Temporary data on the SIM include such entries as the address of the current visitor location register (VLR), which currently administers the mobile station, the number to which the calls must be forwarded, if the subscriber selects call forwarding, and some transient parameters for authentication and ciphering.

The IMSI is permanently stored on the SIM card. The IMSI is one of the pieces of important information used to identify a subscriber within the GSM system. The first three digits of the IMSI identify the mobile country code (MCC) and the next two digits are the mobile network code (MNC). Up to ten additional digits of the mobile subscriber identification number (MSIC) complete the IMSI. For example, 262 02 454 555 5555 identifies a subscriber from Germany, who is paying a private operator having a MNC of 02. The subscriber's network identity number (MSIC) is 454 555 5555. The number with which the subscriber may be reached from the public network is different form the IMSI. This number is the mobile subscriber ISDN number (MSISDN). The MSISDN starts with an area code followed by a seven digit subscriber number. The first digits of this subscriber number identify the subscriber's related HLR. Thus, the PSTN routes a call to the mobile subscriber based on the MSISDN via the GMSC. The GMSC, based on its internal tables, correlates the MSISDN to the specific HLR, which has to be queried to get subscriber information. The HLR replies with specific information about the identity of the MSC where the subscriber is currently located and essentially provides a number where the subscriber can be reached. This is know as the mobile station roaming number (MSRN).

Similarly with the Personal Communication Services (PCS) 1900 MHz system, which is a derivative of the GSM/DCS 1800 standard with an 8 time-slot air interface, a subscriber's directory number is usually a geographic number. For example, the subscriber's directory number under the North American Numbering Plan (NANP) is in the NPA-NXX-XXXX format, where NPA is the Numbering Plan Area code, NXX is the central office Code, and XXXX identifies the station umber. The geographic number uniquely identifies both the subscriber and the physical location of the subscriber's terminal.

As subscribers move form location to location within the cellular network, mobile subscribers often relocate from a first service area served by a first HLR to a second service area serviced by a second HLR. By relocating, a particular mobile station's pre–existing subscriber agreement with the first HLR is terminated and a new subscription agreement with the second HLR is established. However, MSIDSN numbers are pre–assigned to each HLR, and therefore a relocating mobile subscriber must be assigned a new MSISDN number within the series pre–assigned to the second HLR. Changing the assigned MSISDN number is a cumbersome process in part because the mobile subscriber has to have the mobile terminal serviced to change the MSISDN. Furthermore, the mobile subscriber must also notify all appropriate parties of the new MSISDN number.

To provide number portability, a central database have been proposed for providing routing information. The number portability databases include a network address representing the end office currently serving the terminal. Call processing involving calls to portable numbers require additional routing information that is stored in these external number portability databases. The routing information is normally gathered by sending a query to the number portability database with a predefined protocol.

All non–call associated signaling in GSM is grouped under the mobile application part (MAP) protocols. Non–call–associated signaling implies all signaling dealing with mobility management, security, activation/deactivation of supplementary services and so on. MAP defines the operations between the MSC and the telephone network as well as the MSC, the HLR, and the VLR. MAP is an extension to the International Telecommunication Union–Telecommunication Standardization Sector (ITU–T) Signaling System Number 7 (SS7). Proposals have been presented for using the GSM MAP_SRI (mobile application part send routing information) for querying the number portability database. However, these methods require changes to the MAP protocol. For example, a special number portability flag is needed to indicate whether the number is ported or not.

It can be seen that there is a need for a method that provides number portability database queries without modifications to the MAP protocol.

It can also be seen that there is a need for a method for providing a number portability database query using existing fields.

SUMMARY OF THE INVENTION

To overcome the limitations in the prior art described above, and to overcome other limitations that will become apparent upon reading and understanding the present specification, the present invention discloses a method for providing number portability in a telecommunications network

The present invention solves the above–described problems by providing a method for providing a number portability database query using existing fields.

A method in accordance with the principles of the present invention includes receiving a call, determining how to route the call by looking at an identity information field and determining whether the call is ported or non–ported by analyzing the identity information field.

Other embodiments of a system in accordance with the principles of the invention may include alternative or optional additional aspects. One such aspect of the present invention is that the method further includes providing routing information associated with the call, the routing information including the identity information field, the identity information field further including a mobile station roaming number field and an international mobile subscriber identity field.

Another aspect of the present invention is that the determining how to route the call further includes determining how to route the call by looking at a mobile station roaming number field in the information identity field.

Another aspect of the present invention is that the determining whether the call is ported or non–ported further includes determining whether the call is ported or non–ported by analyzing an international mobile subscriber identity field in the information identity field. However, those skilled in the art will recognize that other fields other than the international mobile subscriber identity field may be used to indicate whether the number is ported or non–ported, e.g., the mobile station roaming number field.

These and various other advantages and features of novelty which characterize the invention are pointed out with particularity in the claims annexed hereto and form a part hereof. However, for a better understanding of the invention, its advantages, and the objects obtained by its use, reference should be made to the drawings which form a further part hereof, and to accompanying descriptive matter, in which there are illustrated and described specific examples in accordance with the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

Referring now to the drawings in which like reference numbers represent corresponding parts throughout:

Fig. 1 illustrates the functional architecture to support service provider number portability according to the present invention;

Fig. 2 illustrates the logical architecture of the public land mobile network ;

Fig. 3 illustrates the a protocol stack used in communication between networks in a communication system;

Fig. 4 illustrates the interrogation of the NP Database and the HLR Simultaneous Call Flows;

Fig. 5 illustrates the Normal GTT for SRI Messages according to the present invention;

Fig. 6 illustrates the signaling for call origination to a non–ported number in a non–PLMN/Ported NPA–NXX range;

Fig. 7 illustrates the signaling when call origination is made to a ported number in a non–PLMN/ported NPA–NXX range;

Fig. 8 illustrates the signaling for a call origination to a non–ported number in a PLMN/ported NPA–NXX range; and

Fig. 9 illustrates the signaling for a call origination to a ported number in a PLMN/ported NPA–NXX range.

DETAILED DESCRIPTION OF THE INVENTION

In the following description of the exemplary embodiment, reference is made to the accompanying drawings which form a part hereof, and in which is shown by way of illustration the specific embodiment in which the invention may be practiced. It is to be understood that other embodiments may be utilized as structural changes may be made without departing from the scope of the present invention.

The present invention provides a method for providing number portability in a telecommunications network. Number portability is implemented according to a Location Routing Number (LRN) method. Depending on whether the number is ported or not, the number portability database returns a MAP_SRI_ack message that provides number portability information. If the number is ported, the number portability database returns the MAP_SRI_ack back to the MSC with the number portability information carried in the MSRN and IMSI fields. The MSRN is the number portability routing information, i.e., the LRN in ANSI, and the IMSI is the first

prefix and a filler. The filler may be arbitrarily selected or may be used to carry the MSISDN received from the original MAP_SRI. If the number is not ported, the MAP_SRI_ack returns to the MSC the MSRN and IMSI fields with the MSRN field containing the MSISDN received form the original MAP_SRI and with the IMSI field containing a second prefix and a filler. The filler may be arbitrarily selected. The MSC then uses the number stored in the MSRN to determine how to route the call and uses the prefix to determine whether the call is toward the ported number of not. If not ported, the signaling required for ported number shall apply. The ported status can be determined by the prefix used in the IMSI. However, those skilled in the art will recognize that other fields other than the international mobile subscriber identity field may be used to indicate whether the number is ported or non–ported, e.g., the mobile station roaming number field.

Fig. 1 illustrates the functional architecture 100 to support service provider number portability according to the present invention. In Fig. 1, mobile terminals 110, 112 communicate via MSCs 114, 116, through the public switched telephone network (PSTN) 120. The MSCs 114, 116, and PSTN 120 have access to Signaling Transfer Points (STP) 122, 124. STPs 122, 124 are programmed controlled packet data switching systems. In operation, an STP will receive a packet data message from another node of the network, e.g., one of the MSCs 114, 116. The STPs 122, 124 analyze point code information in packets and route the packets according to a translation table stored within the STP 122, 124.

The STPs 122, 124 provide the Signaling Connection Control Part (SCCP) functions such as Global Title Translation (GTT) and SCCP management. GTT is used for message delivery (e.g., queries) to application databases. SCCP management is used to manage and reroute traffic based on application availability.

A Home Location Register (HLR) 130 maintains information for the management of mobile subscribers 110, 112. HLR 130 contains the subscription information and may contain the location of each mobile station 110, 112.

The NP database 132 is the database accessed in real time by the MSCs 114, 116 to provide the LRN for a ported subscriber in order to correctly route a call. The NP database 132 contains the number portability information transmitted by the number portability administration center service management system (NPAC–SMS) 140 via the Local Service Management System (LSMS) 142. The NPAC–SMS 140 is a Service Management System responsible for storing and broadcasting to the LSMS(s) 142 NP data updates within a service provider's area. The LSMS 142 is

responsible for distributing the NP data updates from the NPAC–SMS 140 to the service provider's NP database 132. The MSCs 114, 116 perform all the switching functions for mobile stations. This includes the allocation of radio resources, call establishment and handover.

MSs 110, 112 roaming the area of the MSCs 114, 116 are assigned to VLRs 150, 152. VLR 150, 152 are in charge of temporarily storing subscription data for the MSs 110, 112 registered in the area of MSCs 114, 116. A VLR may be collocated with an MSC, as shown in Fig. 1, or may be in charge of one or several MSC areas.

When the initiating MSC 114 determines that a call is to a portable number, i.e., the called party number lies within a portable range, e.g., NPA–NXX , the initiating MSC 114 sends a query to the NP database 132. If the subscriber has ported, the Query Response message returns an LRN to the initiating MSC 114. If the subscriber is not ported, the Query Response message returns the called party number (dialed number) to the initiating MSC 114.

Fig. 2 illustrates the logical architecture 200 of the public land mobile network (PLMN). Network elements exist internally and externally to the PLMN's SS7 Infrastructure. The PLMN includes Equipment Identity Register (EIR) 210 that are used for handset authentication. Home Location Register (HLR) 212 are used for holding subscriber information and Authentication Centers (AUC) 214 are used to create security information for subscriber validation. A Short Message Service Center (SMSC) 216 is used for sending and receiving short messages. The MSC/VLR 220 hold visiting subscribers in order to perform call completion scenarios to and from the handset and the Gateway Mobile Switching Center (GMSC) 222 interface to the PSTN and allow mobile terminated call completion to be performed from PSTN. The SCCP Gateway (SG) 230 interfaces to the external SS7 networks and is used as a firewall for SCCP communication. The SCCP Relay (SR) 240 is used to perform complex Global–Title translations on the Calling and Called Party Addresses which cannot be distributed amongst remote network elements. NBSN 250 is used as an SCCP Gateway to North–American GSM Roaming Partner's PLMNs, and ISBN 252 is used as an SCCP Gateway to International GSM Roaming Partner's PLMNs. The Logical SCCP Elements shown in Fig. 2 may reside on one physical Network Entity or multiple Network Entities depending on the Network Operator's Architecture, e.g., the SG and SR can reside on a standalone STP or on the GMSC/VLR.

In the case of incoming calls to the PLMN 200, if the delivering network(s) is unable to interrogate the HLR 212, the call is routed to an MSC 222. This MSC 222 will interrogate the appropriate HLR 212 and then route the call to the MSC 220 where the mobile station is located. The MSC 222 which performs the interrogation and routing function to the actual location of the mobile is called the Gateway MSC (GMSC). Hereinafter, the term MSC will denote either GMSC or MSC/VLR or both, unless explicitly stated.

In order for Number Portability to operate correctly for Mobile Terminated SMS and Voice/Data Calls within the PLMN the network requires a 10–Digit GTT Node to be deployed within the PLMN 200. This is typically referred to as functionality of the SCCP Relay 240 and can reside on either the MSC/VLR Nodes, standalone STP Nodes, or a separate SCCP Relay Node. In Fig. 2, the SCCP Relay 240 is shown as a standalone platform to identify when the SCCP Relay Functionality is utilized within the PLMN 200.

The location routing number identifies the recipient network to which the subscriber has ported and is used by all switches in the call path to route the call to the recipient network. The recipient network uses the location routing number and the called party number to complete the call to the end user. The switch that obtains the location routing number (initiating MSC) sends an indication in the forward call setup information that the NP status of the called party number has been determined, thus inhibiting subsequent queries at the succeeding switches/network. The call is routed using the called party number if the subscriber is not ported or error/time–out occurs.

For numbers ported into the PLMN 200, the location routing number will be used to route to at least one Gateway MSC (GMSC) 222 of the PLMN 200. Multiple location routing numbers may be assigned to the same GMSC 222 or same set of GMSCs 222. All location routing numbers routed to a particular GMSC 222 are recognized by that GMSC 222.

When the number portability database 260 receives the request for routing information from the MSC 220, the number portability database 260 extracts the MSISDN and determines whether the number is ported or not. If the number is ported, the number portability database 260 returns the acknowledgment back to the MSC 220 with the number portability information carried in the MSRN and IMSI fields. The MSRN is the number portability routing information, i.e., the location routing number in ANSI, and the IMSI is the first prefix and a filler. The filler may

be arbitrarily selected or may be used to carry the MSISDN received from the original MAP_SRI. If the number is not ported, the acknowledgment returns to the MSC 220 the MSRN and IMSI fields with the MSRN field containing the MSISDN received form the original request for routing information and with the IMSI field containing a second prefix and a filler. The filler may be arbitrarily selected. The MSC 220 then uses the number stored in the MSRN to determine how to route the call and uses the prefix to determine whether the call is toward the ported number of not. If not ported, the signaling required for ported number shall apply. The ported status can be determined by the prefix used in the IMSI. However, those skilled in the art will recognize that other fields other than the IMSI field may be used to indicate whether the number is ported or non–ported, e.g., the mobile station roaming number field.

Fig. 3 illustrates the a protocol stack 300 used in communication between networks in a communication system. The same protocols should exist in each layer of two network elements if they wish to communicate with each other. This is called the principle of the peer–to–peer communications. The lowest level protocol is the Message Transfer Part (MTP) 310. The MTP 310 is responsible for transferring messages through the signaling link, routing the signaling information to the proper PCM line, controlling and testing the signaling network. MTP 310 provides a physical interface to higher level protocols.

The next layer is the SCCP 312, which provides different classes of services for the upper layers. From these service classes only two are used in GSM. Connection–oriented services provide means to establish a virtual connection between two network elements. In connectionless mode, SCCP 312 enables to transfer signaling messages through the network without exactly knowing the network structure. In this case no speech connection is set up (e.g. location update when roaming) and routing is performed by adding and analyzing a so called global title.

The Transaction Capabilities Application Part (TCAP) 320 was designed for signaling between applications. On the one hand it provides a component handling facility which enables to operate the data units, through which two users communicate (e.g. commands and responses). On the other hand, through the transaction facility, TCAP 320 handles several connectionless SCCP 312 messages (components) as one context (dialogue) between two network elements and enables to maintain several simultaneous dialogues between two applications.

The highest level protocol, the Mobile Application Part (MAP) 330 has functions related to mobile telephony such as call control, location updating, HLR inquiries, roaming number inquiries, short message service, handovers, subscriber administration, supplementary services and equipment identification. MAP 330 is important that these functions do not require the establishment of a speech connection during signaling. The MAP protocol 330 has various different versions depending on the network element to which it is applied. MAP–M, V, H and E are the MAP versions of the MSC, VLR, HLR and EIR respectively.

Fig. 4 illustrates the interrogation of the NP Database and the HLR Simultaneous Call Flows 400. The call flows 400 in Fig. 4 pertain to number portability only. For example, the signaling from the HLR to the VLR currently serving the mobile subscriber (used to obtain the roaming number) is not shown. Originating call or incoming call 410 with called party number is received by the MSC 412. The MSC 412 detects that the called number has the following attributes and sends an SRI Message 414 using the Called Party Number :–

1. The NPA–NXX is in a PLMN Range; or
2. The NPA–NXX is within a Non–PLMN Range which has been marked as a Ported Range.

In the first scenario, the SCCP Relay Function 416 recognizes the 10–Digit GTT (with Translation Type assigned for MAP_SRI) and routes the SRI 418 to the HLR 420. The subscriber is currently active and a roaming number 422 is returned to the GMSC/VLR 412 with a Roaming Number and IMSI number. The IMSI does not contain any prefix used to identify the response is from NP–SCP 424. The call is setup 425 using the roaming number 426.

In the second scenario 430, the SCCP Relay Function 416 does not recognize the 10 Digit GTT (with Translation Type assigned for MAP_SRI) and routes the SRI 432 to the NP–SCP 424. The NP–SCP database 424 returns a MAP_SRI_ack message 434. The RN 436 contains either the 10 digit location routing number for the called party number or the actual called party number. A first subset 438 of the second scenario 430 occurs when the NP–SCP returns the location routing number 440. If the NP–SCP 424 returns the location routing number, the NP–SCP 424 places a pre–defined prefix in the IMSI field to identify that the RN contains a location routing number. The MSC 412 detects this pre–defined prefix and establishes the call using the location routing number if the location routing number

is not owned by the PLMN. Otherwise, the MSC 412 will release the call using normal call release procedures.

A second subset 444 of the second scenario 430 occurs when the NP–SCP 424 returns a Called Party Number. If the NP–SCP database 424 returns the Called Party Number, the NP–SCP 424 places a pre–defined prefix in the IMSI field 442 to identify that the RN 436 contains a Called Party Number. The MSC 412 detects this pre–defined prefix and the PLMN is the donor network for the portable NPA–NXX, then the MSC 412 will release the call 446 using normal call release procedures. This is the case when the called number is portable but unallocated.

A third subset 450 of the second scenario 430 occurs when the NP–SCP 424 returns a Called Party Number. If the NP–SCP database 424 returned the Called Party Number, the NP–SCP 424 places a pre–defined prefix in the IMSI field 442 to identify the RN 436 contains a Called Party Number. The MSC 412 detects this pre–defined prefix and the PLMN is not the donor network for the portable NPA–NXX, then the MSC 412 will setup the call using the called party number 452. This is the case when the called number is within a portable NPA–NXX range, but not ported and not served by this PLMN.

Fig. 5 illustrates the Normal GTT for SRI Messages 500 according to the present invention. In Fig. 5, the SCCP signaling encountered for SCCP Messages which are routed through the SCCP Relay and the Global–Title Analysis exists within the SCCP Relay Node 510. A mobile originated or mobile terminated call is made and a SRI Message 512 is sent from the GMSC/VLR 514. The SCCP Message 516 Called Party Global–Title Address is analyzed and is then translated into a new GT Address destination and is forwarded to HLR 520. The SRI acknowledgment 518 is sent back to the GMSC/VLR 514 within the Network. The Routing Information 522 is obtained from the HLR 520.

Fig. 6 illustrates the signaling 600 for call origination to a non–ported number in a non–PLMN/Ported NPA–NXX range. In this scenario, the GMSC/VLR 614 determines the attributes for the dialed number requires NP–SCP database query. For example, the GMSC/VLR 614 determines that the dialed number is not within a PLMN NPA–NXX and that the dialed number is associated with a Ported NPA–NXX number range. The SRI Message 612 is sent to the SCCP Relay Node 610 for Global–Title Analysis on the Called Party Address. Global–Title Analysis is not available to route the call and therefore the Number Portability Application via the NP–SCP 620 in SRI message 616 is invoked. The SRI response

618 is sent back with a pre–defined prefix set in the IMSI field 622 to identify the routing number containing the called number. The call is routed using MF or ISUP signaling. If the signaling is ISUP then the IAM parameters are populated according to the ANSI standards. For example, the called party number is the dialed number, the generic address parameter is empty and the forward call indicator bit M indicates that a number is translated.

Fig. 7 illustrates the signaling 700 when call origination is made to a ported number in a non–PLMN/ported NPA–NXX range. In this scenario, the GMSC/VLR 714 determines the attributes for the dialed number requires NP–SCP database query. For example, the dialed number is determined to not be within a PLMN NPA–NXX and the dialed number is determined to be associated with a Ported NPA–NXX number range. The SRI Message 712 is sent to the SCCP Relay Node 710 for Global–Title Analysis on the Called party Address. Global–Title Analysis is not available to route the call and therefore the Number Portability Application via NP–SCP 720 is SRI message 716 is invoked. The SRI response 718 is sent back a pre–defined prefix set in the IMSI field 722 to identify the routing number containing the location routing number. If the location routing number is not from the PLMN, then the call is routed using MF or ISUP signaling. If the signaling is ISUP, then IAM parameters will be populated according to the ANSI standards. For example, the called party number is the location routing number, the generic address parameter is the dialed number and a forward call indicator bit M indicates that the number translated

Fig. 8 illustrates the signaling 800 for a call origination to a non–ported number in a PLMN/ported NPA–NXX range. In this scenario,, the SCCP signaling 800 encountered for a dialed number requires a database lookup for a PLMN number. In this scenario, the call origination and dialed digits are received by the GMSC/VLR 814. The GMSC/VLR 814 determines the attributes for the dialed number, e.g., the dialed number is determined to be within a PLMN NPA–NXX. The SRI Message 812 is sent to the SCCP Relay Node 810 for Global–Title Analysis on the Called party Address. Global–Title Analysis is not available to route the call and therefore the Number Portability Application via the NP–SCP 820 in SRI message 816 is invoked. The SRI response 818 is sent back with a pre–defined prefix set in the IMSI field 822 to identify the routing number containing the called number. The call is released with an ISUP/MF release code mapped from the MAP unknown subscriber and cleared down using MF or ISUP signaling.

Fig. 9 illustrates the signaling 900 for a call origination to a ported number in a PLMN/ported NPA–NXX range. In this scenario, the SCCP signaling 900 encountered for a dialed number requires a database lookup for a PLMN number. The call origination and dialed digits are received by the GMSC/VLR 914. The GMSC/VLR 914 determines that the attributes of the dialed number, e.g., the dialed number is determined to be within a PLMN NPA–NXX. The SRI Message 912 is sent to the SCCP Relay Node 910 for Global–Title Analysis on the Called party Address. Global–Title Analysis is not available to route the call and therefore the Number Portability Application via NP–SCP 920 in SRI message 916 is invoked. The SRI response 918 is sent back with a pre–defined prefix set in the IMSI field 922 to identify the routing number containing the location routing number. If the location routing number is not from the PLMN then the call is routed using MF or ISUP signaling. If the signaling is ISUP, then IAM parameters will be populated according to the ANSI standards. For example, the called party number is the location routing number, the generic address parameter is the dialed number and the forward call indicator bit M is the number translated.

The foregoing description of the exemplary embodiment of the invention has been presented for the purposes of illustration and description. It is not intended to be exhaustive or to limit the invention to the precise form disclosed. Many modifications and variations are possible in light of the above teaching. It is intended that the scope of the invention be limited not with this detailed description, but rather by the claims appended hereto.

WHAT IS CLAIMED IS:

1. A method for providing number portability in a telecommunications network, comprising:

receiving a call;

determining how to route the call by looking at an identity information field; and

determining whether the call is ported or non–ported by analyzing the identity information field.

2. The method of claim 1 further comprising providing routing information associated with the call, the routing information including the identity information field, the identity information field further comprising a mobile station roaming number field and an international mobile subscriber identity field.

3. The method of claim 1 wherein the determining how to route the call further comprises determining how to route the call by looking at a mobile station roaming number field in the information identity field.

4. The method of claim 1 wherein the determining whether the call is ported or non–ported further comprises determining whether the call is ported or non–ported by analyzing an international mobile subscriber identity field in the information identity field.

5. The method of claim 1 further comprising providing routing information associated with the call, the routing information including the identity information field, the identity information field further comprising a mobile station roaming number field and an international mobile subscriber identity field, wherein the determining how to route the call further comprises determining how to route the call by looking at a mobile station roaming number field in the information identity field, and wherein the determining whether the call is ported or non–ported further comprises determining whether the call is ported or non–ported by analyzing an international mobile subscriber identity field in the information identity field.

6. The method of claim 5 further comprising providing a routing number in the mobile station roaming number field and providing an indicator and a mobile station ISDN in the international mobile subscriber identity field.

7. The method of claim 6 wherein the indicator further comprises a first prefix.

8. The method of claim 7 wherein the first prefix indicates that the call is ported.

9. The method of claim 5 further comprising requesting routing information for the call, a routing request including a mobile station ISDN, providing the mobile station ISDN from the routing request in the mobile station roaming number field and providing an indicator in the international mobile subscriber identity field.

10. The method of claim 9 wherein the indicator further comprises a second prefix.

11. The method of claim 10 wherein the a second prefix indicates that the call is non–ported.

12. The method of claim 5 wherein the second prefix identifies that the mobile station roaming number contains the called number.

13. The method of claim 12 wherein the call is released with an ISDN User Part or Multifrequency signaling.

14. The method of claim 9 wherein the international mobile subscriber identity field further includes an arbitrary filler.

15. The method of claim 14 wherein the filler includes the mobile subscriber ISDN from the routing request.

16. The method of claim 5 further comprising the step of determining whether the called number is in a public land mobile network range or whether the called number is within a non–public land mobile network range.

17. The method of claim 16 further comprising routing a request for routing information to a home location register when the called number is in a public land mobile network range.

18. The method of claim 17 further comprising returning a mobile station roaming number with a routing number therein and a international mobile station number, wherein the international mobile station number does not include a prefix.

19. The method of claim 18 further comprising setting-up the call using the routing number.

20. The method of claim 16 further comprising providing a location routing number or an actual called party number in the mobile station roaming number field when the called number is not in a public land mobile network range.

21. The method of claim 20 further comprising providing a predefined prefix in the international mobile station number field indicating that the public land mobile network is a donor.

22. The method of claim 21 further comprising releasing the call using normal call release procedures.

23. The method of claim 20 further comprising providing a predefined prefix in the international mobile station number field indicating that the public land mobile network is not a donor.

24. The method of claim 23 further comprising releasing the call using a called party number.

25. The method of claim 20 further comprising providing a prefix in the international mobile station number field to indicate that the mobile station roaming number field includes the location routing number.

26. The method of claim 25 further comprising establishing the call using the location routing number when the location routing number is not owned by the public land mobile network.

27. The method of claim 26 further comprising establishing the call using the normal call release procedures when the location routing number is owned by the public land mobile network.

28. The method of claim 1 further comprising providing routing information associated with the call, the routing information including the identity information field, the identity information field further comprising a mobile station roaming number field and an international mobile subscriber identity field, wherein the mobile station roaming number field further comprises an indicator.

29. The method of claim 28 wherein the indicator further comprises a first prefix for indicating that the call is ported.

30. The method of claim 28 wherein the indicator further comprises a second prefix for indicating that the call is non–ported.

31. The method of claim 1 further comprising providing routing information associated with the call, the routing information including the identity information field, the identity information field further comprising a mobile station roaming number field and an international mobile subscriber identity field, wherein the mobile station roaming number field comprises a routing number and an indicator and the international mobile subscriber identity field further comprises a mobile station ISDN.

32. The method of claim 31 wherein the indicator further comprises a first prefix for indicating that the call is ported.

33. The method of claim 31 wherein the indicator further comprises a second prefix for indicating that the call is non–ported.

34. The method of claim 1 further comprising requesting routing information for the call, a routing request including a mobile station ISDN, providing routing information associated with the call, the routing information including the identity information field, the identity information field further comprising a mobile station roaming number field and an international mobile subscriber identity field, wherein the mobile station roaming number field comprises

an indicator and the mobile station ISDN from the routing request, and the international mobile subscriber identity field further comprises a mobile station ISDN.

35. The method of claim 34 wherein the indicator further comprises a second prefix.

36. The method of claim 35 wherein the a second prefix indicates that the call is non–ported.

37. An intelligent telecommunications network configured for number portability, comprising:

an initiating mobile services switching center for receiving a call for a portable terminal;

a serving mobile services switching center, operatively coupled to the initiating mobile services switching center, the serving mobile services switching center providing services to the portable terminal;

a number portability database for providing network addresses representing the mobile services switching center currently serving the called portable terminal in response to a query from the initiating mobile services switching center; and

a signaling transfer point, coupling the number portability database to the initiating and serving mobile services switching center, the signaling transfer point providing programmed controlled packet data switching for received packet data messages from nodes of the network;

wherein the signaling transfer point routes an identity information field from the number portability database to the initiating mobile services switching center, the initiating mobile services switching center determining how to route the call by looking at an identity information field and determining whether the call is ported or non–ported by analyzing the identity information field.

38. The intelligent telecommunications network of claim 37 wherein the number portability database further provides routing information associated with the call, the routing information including the identity information field, the identity information field further comprising a mobile station roaming number field and an international mobile subscriber identity field.

39. The intelligent telecommunications network of claim 37 wherein the initiating mobile services switching center determines how to route the call by looking at the mobile station roaming number field in the information identity field.

40. The intelligent telecommunications network of claim 37 wherein the initiating mobile services switching center determines whether the call is ported or non–ported by analyzing an international mobile subscriber identity field in the information identity field.

41. The intelligent telecommunications network of claim 37 wherein the number portability database provides routing information associated with the call, the routing information including the identity information field, the identity information field further comprising a mobile station roaming number field and an international mobile subscriber identity field, wherein the mobile station roaming number field further comprises an indicator.

42. The intelligent telecommunications network of claim 41 wherein the indicator further comprises a first prefix for indicating that the call is ported.

43. The intelligent telecommunications network of claim 41 wherein the indicator further comprises a second prefix for indicating that the call is non–ported.

44. The intelligent telecommunications network of claim 37 wherein the number portability database provides routing information associated with the call, the routing information including the identity information field, the identity information field further comprising a mobile station roaming number field and an international mobile subscriber identity field, wherein the mobile station roaming number field comprises a routing number and an indicator, and the international mobile subscriber identity field further comprises a mobile station ISDN.

45. The intelligent telecommunications network of claim 44 wherein the indicator further comprises a first prefix for indicating that the call is ported.

46. The intelligent telecommunications network of claim 44 wherein the indicator further comprises a second prefix for indicating that the call is non–ported.

47. The intelligent telecommunications network of claim 37 wherein the initiating mobile services switching center requests routing information for the call, a routing request including a mobile station ISDN, the number portability database providing routing information associated with the call, the routing information including the identity information field, the identity information field further comprising a mobile station roaming number field and an international mobile subscriber identity field, wherein the mobile station roaming number field comprises an indicator and the mobile station ISDN from the routing request, and the international mobile subscriber identity field further comprises a mobile station ISDN.

48. The intelligent telecommunications network of claim 47 wherein the indicator further comprises a second prefix.

49. The intelligent telecommunications network of claim 48 wherein the a second prefix indicates that the call is non–ported.

50. The intelligent telecommunications network of claim 37 wherein the number portability database provides routing information associated with the call, the routing information including the identity information field, the identity information field further comprising a mobile station roaming number field and an international mobile subscriber identity field, wherein the initiating mobile services switching center determines how to route the call by looking at a mobile station roaming number field in the information identity field, and determines whether the call is ported or non–ported by analyzing an international mobile subscriber identity field in the information identity field.

51. The intelligent telecommunications network of claim 50 wherein the mobile station roaming number field further comprises a routing number and the international mobile subscriber identity field further comprises an indicator and a mobile station ISDN.

52. The intelligent telecommunications network of claim 51 wherein the indicator further comprises a first prefix.

53. The intelligent telecommunications network of claim 52 wherein the first prefix indicates that the call is ported.

54. The intelligent telecommunications network of claim 37 wherein the initiating mobile services switching center requests routing information for the call, a routing request including a mobile station ISDN, the mobile station roaming number field comprising the mobile station ISDN from the routing request and the international mobile subscriber identity field comprises an indicator.

55. The intelligent telecommunications network of claim 54 wherein the indicator further comprises a second prefix.

56. The intelligent telecommunications network of claim 55 wherein the a second prefix indicates that the call is non–ported.

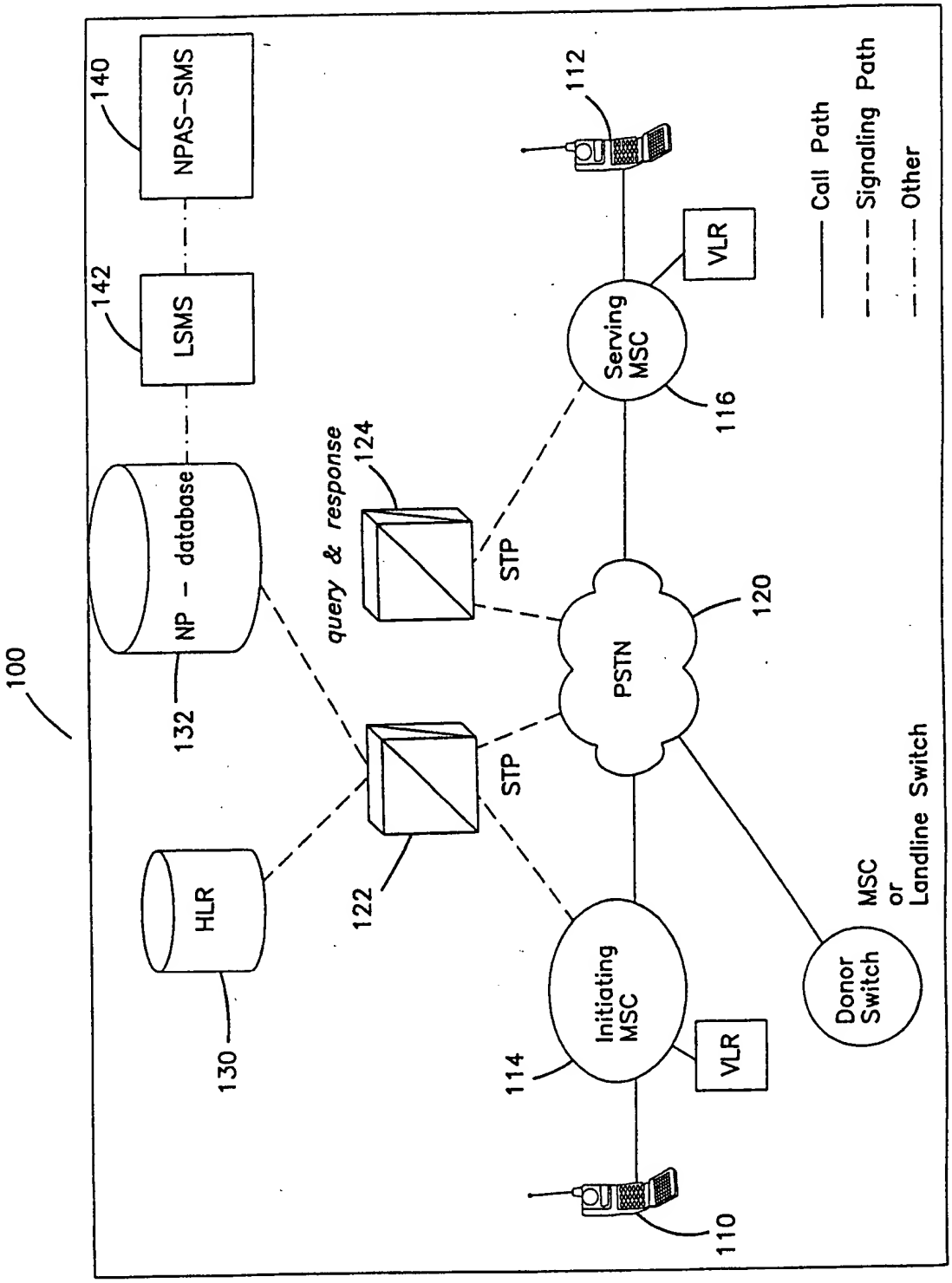
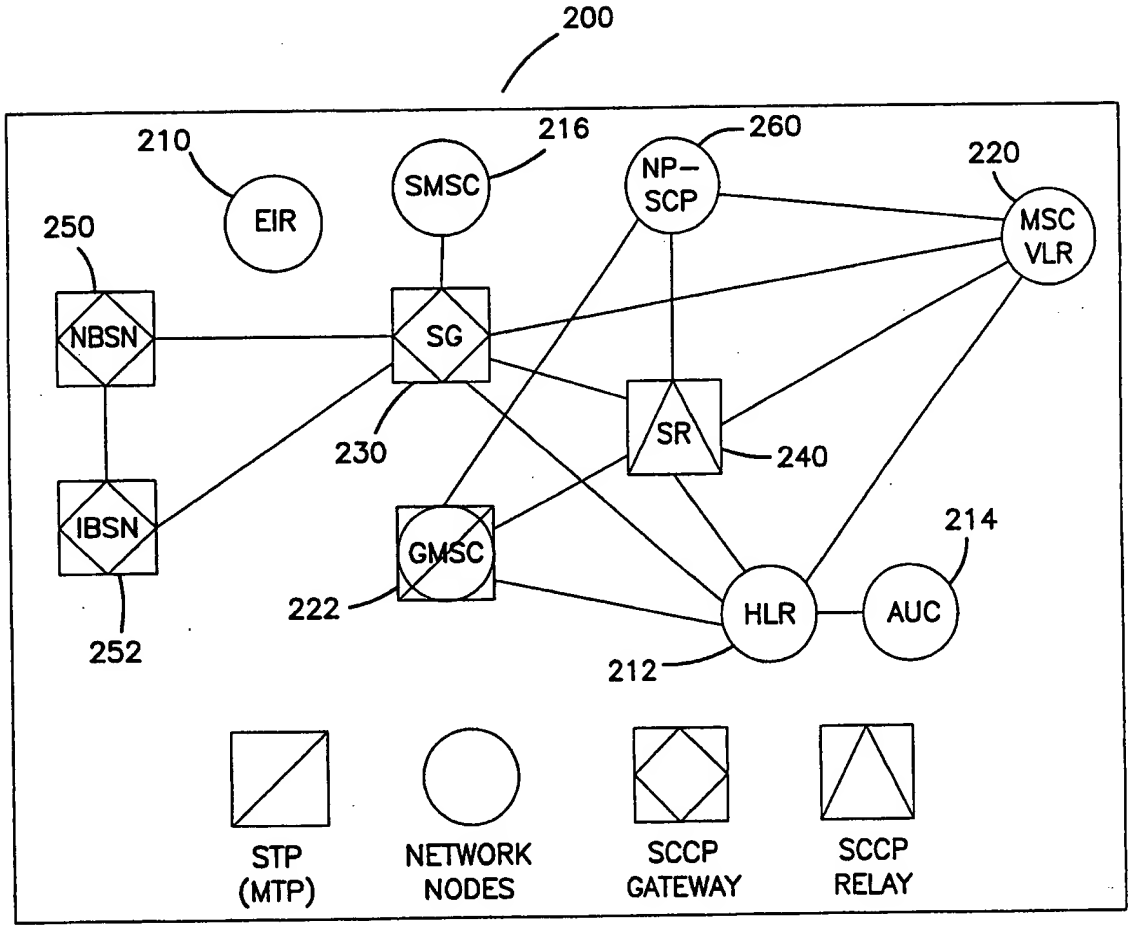


FIG. 1

FIG. 2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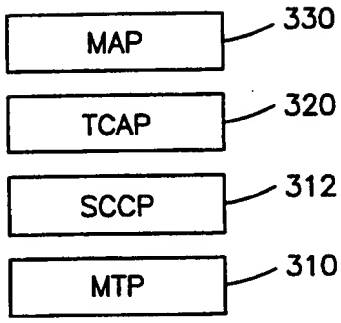
NP–
SCP
220
MSC
VLR
250
NBSN
SG
230
SR
240
IBSN
252
GMSC
222
214
HLR
AUC
212
STP
(MTP)
NETWORK
NODES
SCCP
GATEWAY
SCCP
RELAY

FIG. 3



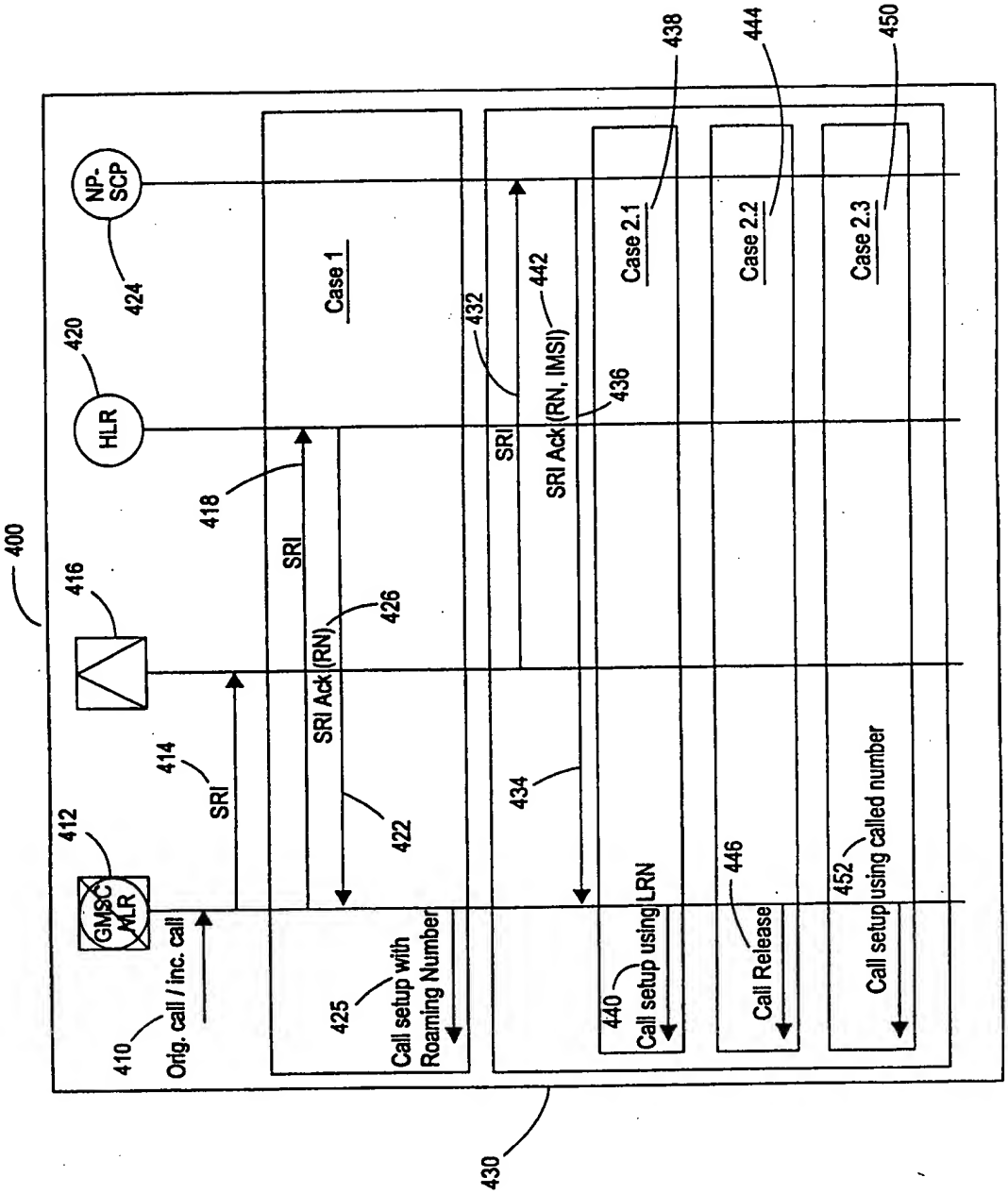


FIG. 4

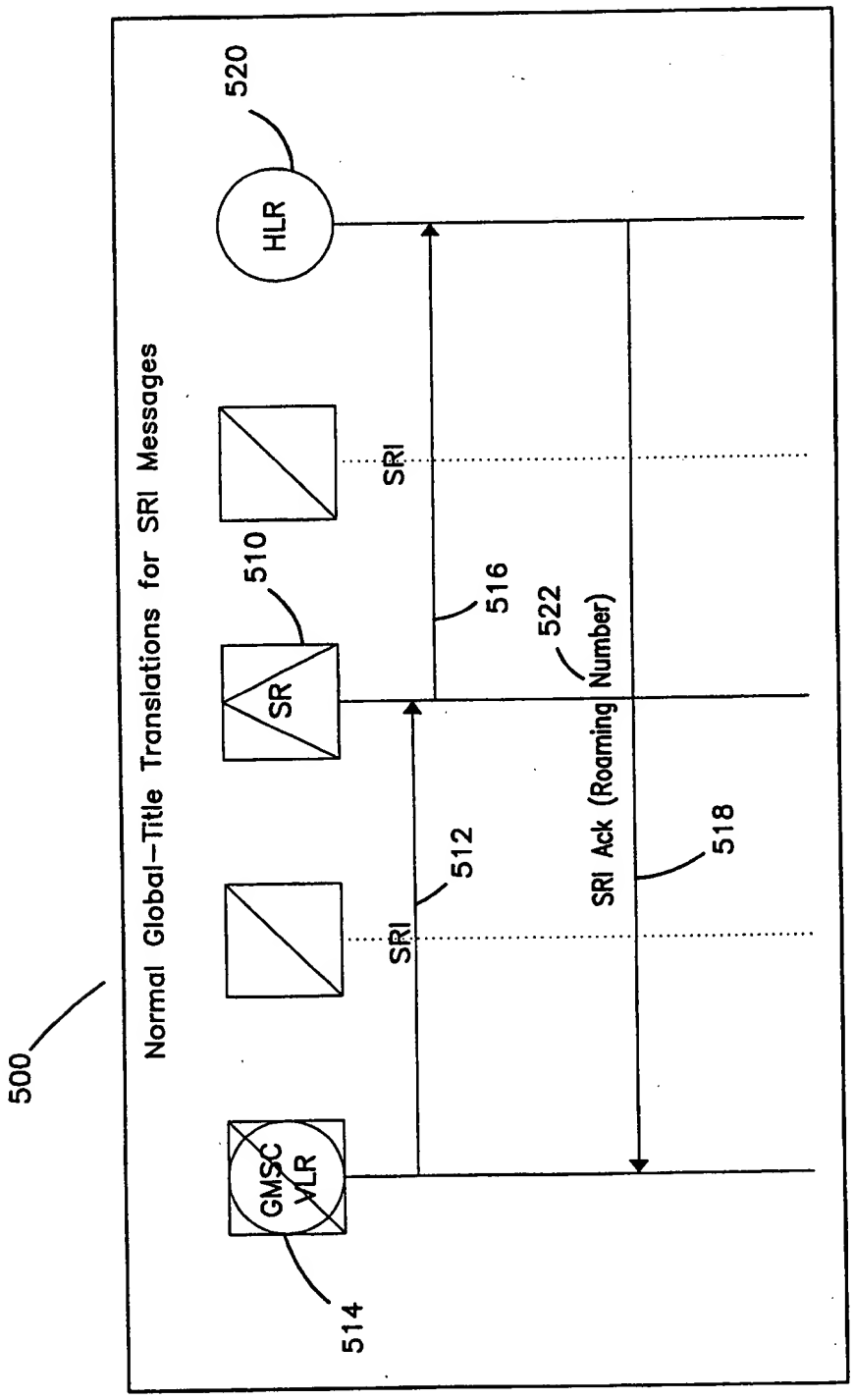
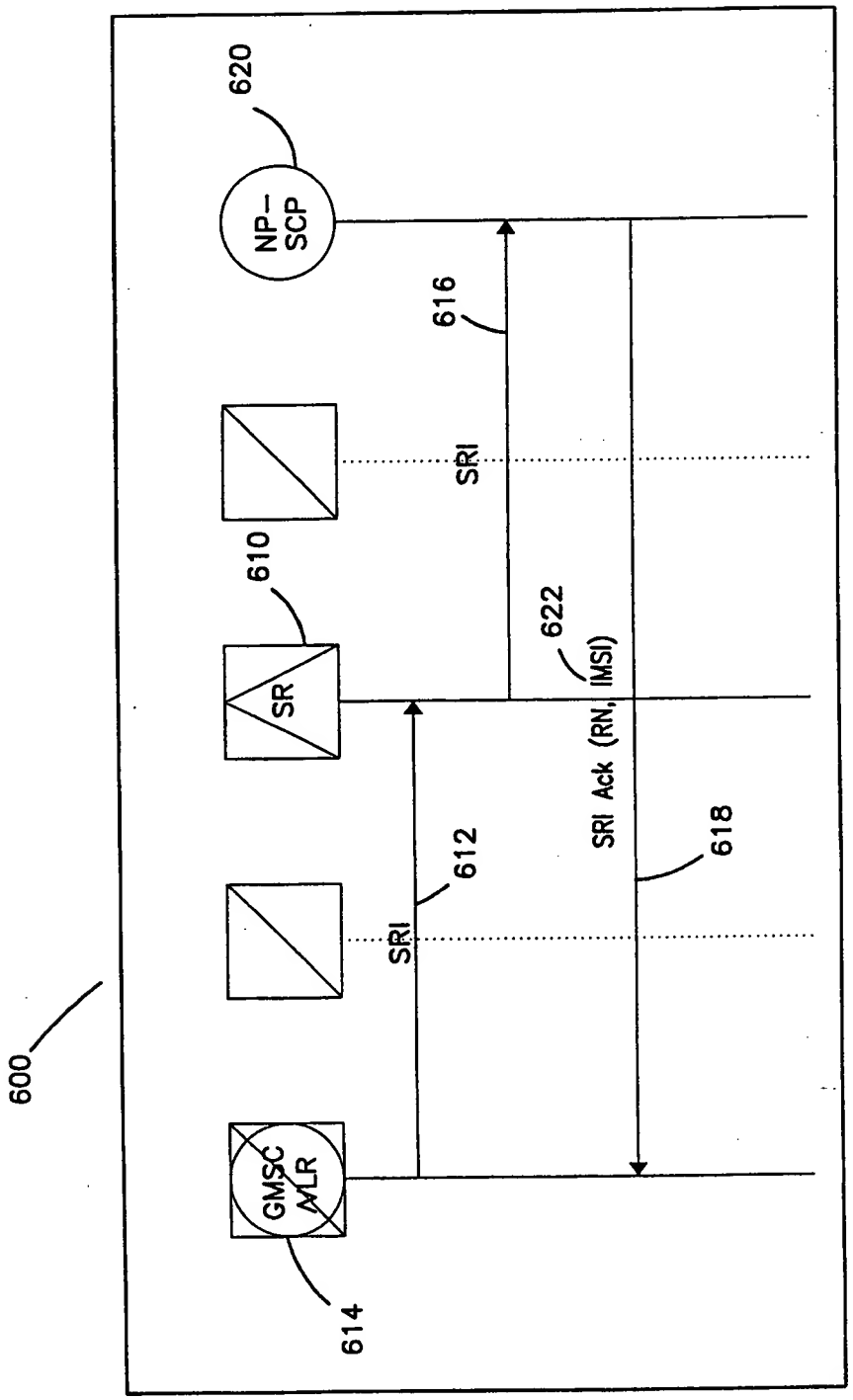


FIG. 5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620
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616
SRI
610
SR
622
SRI Ack (RN, IMSI)
612
SRI
618
GMSC MLR
614

FIG. 6

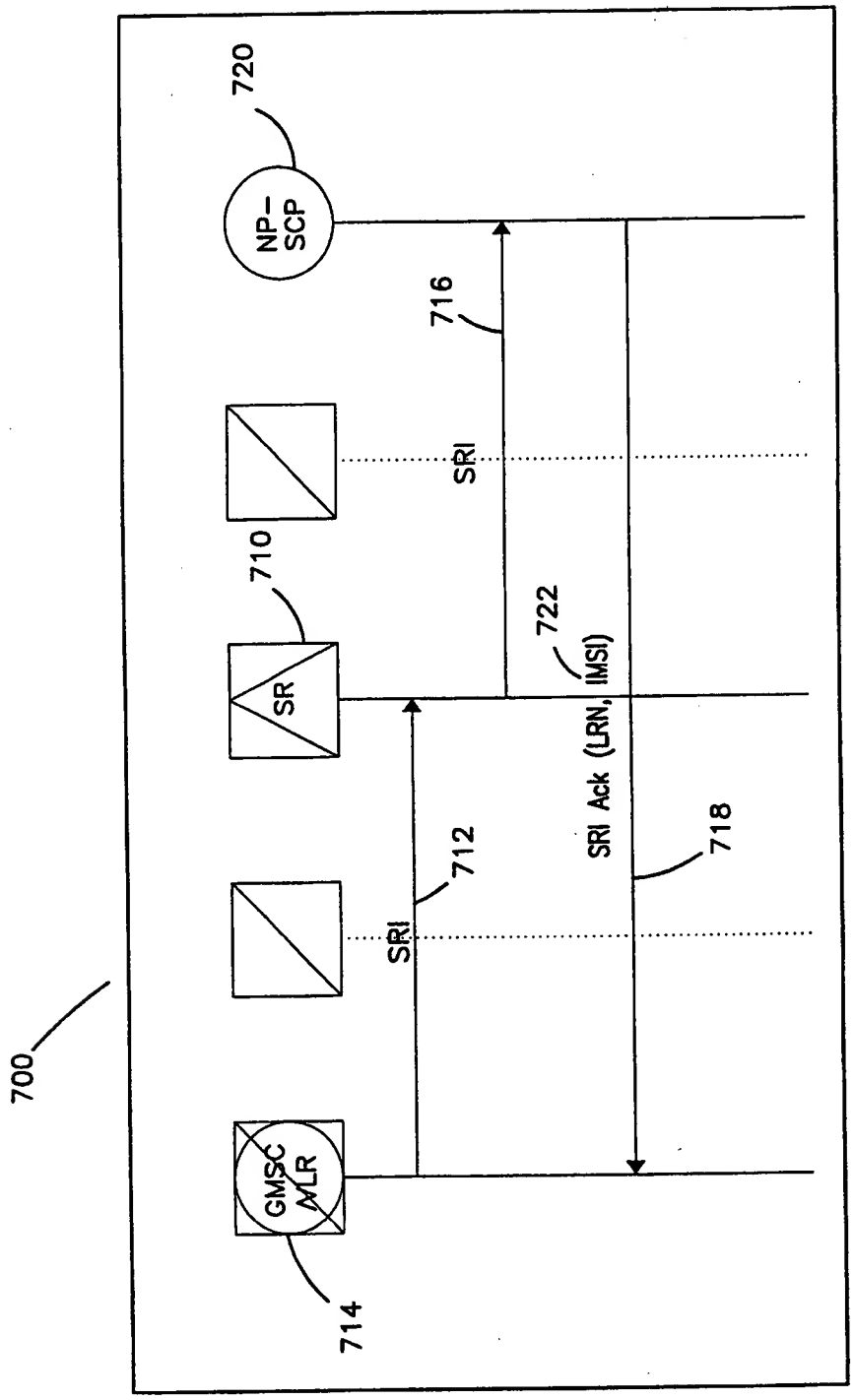
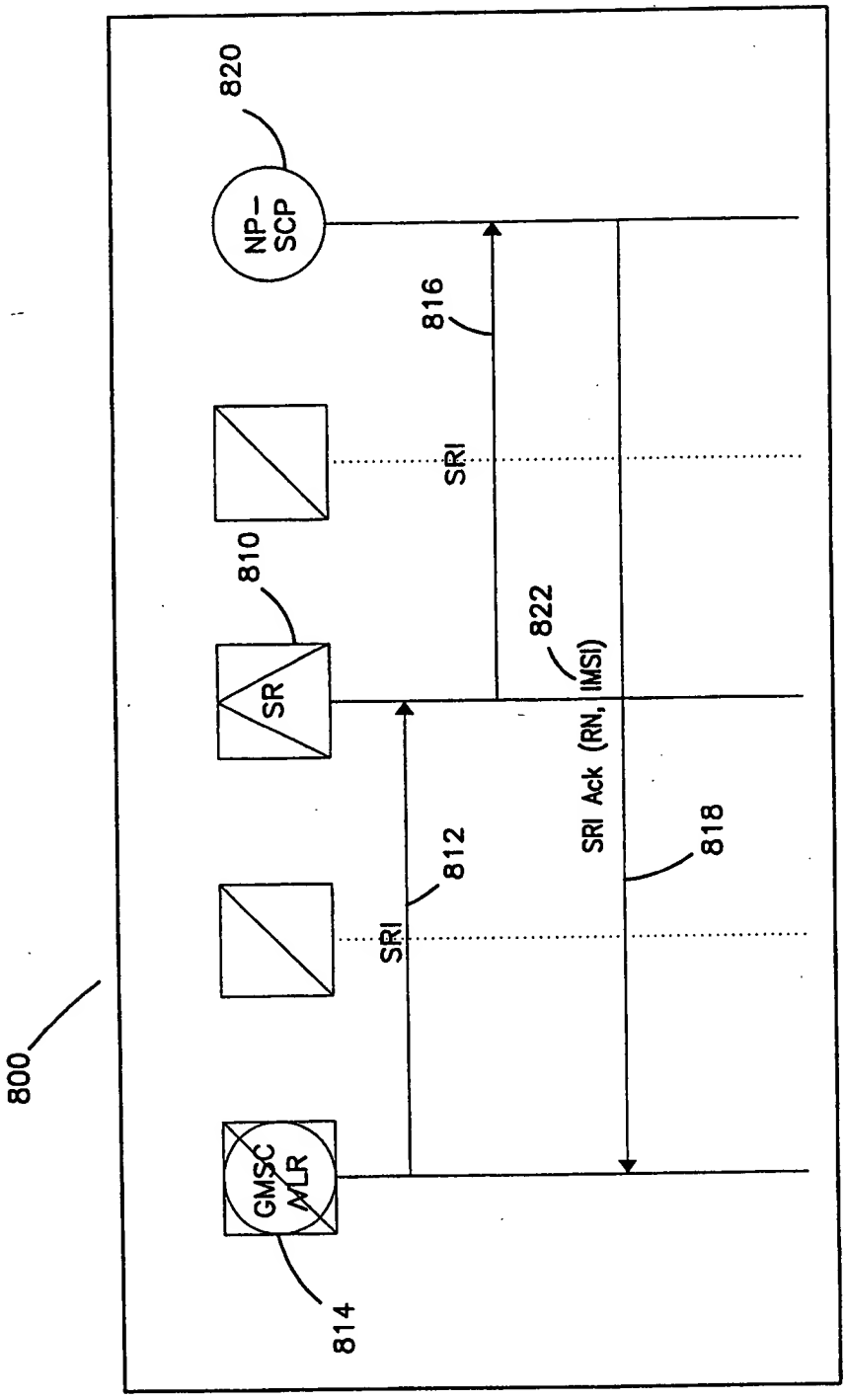

700
720
NP-SCP
716
SRI
710
SR
722
SRI Ack (LRN, IMSI)
712
SRI
718
GMSC MLR
714

FIG. 7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820
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SRI
810
SR
822
SRI Ack (RN, IMSI)
812
SRI
818
GMSC MLR
814

FIG. 8

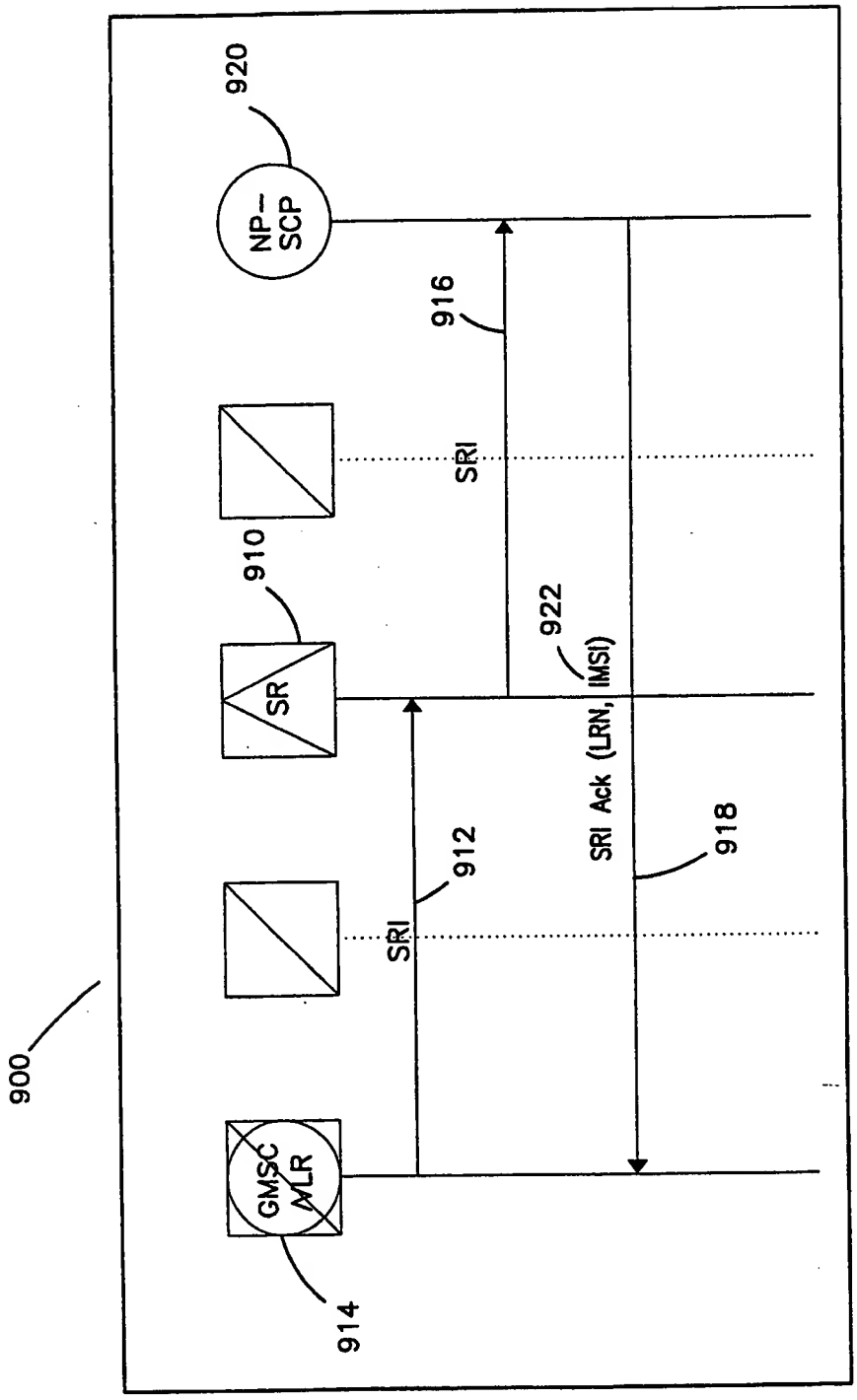

FIG. 9

INTERNATIONAL SEARCH REPORT

Int tional Application No
PCT/US 99/17410

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 H04Q7/38 H04Q3/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 H04Q

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 98 18269 A (ERICSSON TELEFON AB L M) 30 April 1998 (1998-04-30) page 20, line 4 -page 24, line 19 page 25, line 25 -page 30, line 6 page 42, line 4 -page 43, line 23 page 47, line 4 - line 11	1-56
X	WO 98 11754 A (ERICSSON GE MOBILE INC) 19 March 1998 (1998-03-19) page 6, line 17 -page 9, line 32 page 11, line 29 -page 13, line 10	1-56

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
10 November 1999	17/11/1999

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040. Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Heinrich, D

Form PCT/ISA/210 (second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

Information on patent family members

Int tional Application No
PC./US 99/17410

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 9818269 A	30-04-1998	AU 4797397 A	15-05-1998
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		EP 0932984 A	04-08-1999
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		NO 991774 A	16-06-1999
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		EP 0925705 A	30-06-1999